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Exploring nonmarket values for the social impacts of environmental policy change

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Abstract

Although the majority of contingent valuation studies have been for environmental goods, the method can be applied to public goods in general. Further, a specific environmental policy may generate both positive and negative nonmarket values. This *exploratory* study investigates the presence of nonmarket values for maintaining the status quo land use and avoiding social impacts from an environmental policy change. The test case, grazing reform on federal lands in New Mexico, was chosen because of the complexity of the public debate. By switching the traditional perspective, we demonstrate the need to accommodate multi-dimensionality in nonmarket research into controversial policies. © 1998 Elsevier Science B.V.

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> But sauce for the goose is surely sauce for the gander. Since costs are the dual of benefits, I see no reason why the contingent valuation method cannot or should not be used for regulatory costs as well as benefits.—Paul R. Portney (1994:13).

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1. Introduction

While the use of the survey-based contingent valuation (CV) method for estimating the economic value of nonmarket environmental goods has grown rapidly, its application remains controversial (Diamond and Hausman, 1994; Hanemann, 1994a; Hausman, 1993). From a measurement perspective, the most problematic component is the category of nonuse, or passive use values—contemplative values not associated with any direct in situ use of the resource. An additional concern is that the pattern of past CV surveys may have systematically neglected nonmarket values associated with development (Rosenthal and Nelson, 1992). In the typical environmental policy debate, public preferences may be complex and multi-dimensional (Gregory et al., 1993). A review of the historical development of nonmarket valuation reveals numerous discussions accepting the theoretical possibility of nonmarket values not attached to environmental services, and to negative values attached to specific environmental policy proposals. To the extent that such values exist for an environmental policy and are excluded from measurement, an inherent bias may be introduced into public policy analyses.

The objective of this exploratory study is to investigate the potential significance of nonmarket values for the social impacts of a proposed environmental policy change. The test case, grazing reform on federal lands in New Mexico (NM), was chosen because of the complexity of the surrounding public debate. This provides the opportunity for reversing the traditional CV perspective, and assessing the 'other side of the analytical ledger' (Portney, 1994).

Some current CV survey guidelines (Arrow et al., 1993; Portney, 1994) advocate extremely expensive designs (e.g., lengthy personal interviews, discrete choice formats, and numerous experimental treatments). The full combination of these design recommendations may create disincentives for researching controversial side issues (Kahneman and Ritov, 1994). In response, Green et al. (1994) advocate a two-stage process for methodological investigations of CV, with simplified procedures used in initial investigations, prior to full blown studies. Using a telephone survey and modest sample ($n = 684$), we adopt a targeted approach for analyzing a specific facet of the measurement problem. A regular quarterly profile of NM residents provides a low-cost survey vehicle. We do not claim to measure the full range of values associated with public lands grazing reform, and no attempt is made to compute aggregate benefits and costs.

2. Whither nonmarket values for social impacts?

Although the vast majority of CV studies of nonuse or passive use values have been directed to environmental goods, the method can be applied to public goods and policies in general. There is growing literature both involving and advocating such extensions, ranging from the arts to space exploration. Theoretically, nonmar-

ket values cannot be limited to environmental concerns; they may be attached to a wide variety of goods and services. Further, a specific environmental policy may have both positive and negative nonmarket values associated with it. This is not a new line of thought in the historical development of nonmarket valuation. Instead, what stands out is the paucity of empirical evidence on the significance of nonmarket values for the social impacts of environmental policy change.

There is no clear demarcation line of what might be the source of nonuse or passive use values. Krutilla (1967) observes that historical and cultural features, and rare works of art may be the sources of nonuse values. Randall and Stoll (1983) p. 268, argue that empirically significant nonuse values are not confined to natural objects, and may ''occur for human artifacts and cultural manifestations, from historic buildings to grand opera''. Following this line, Rosenthal and Nelson (1992) argue that nonuse values may exist for everything from national defense, and 1968 Ford Mustangs, to jobs in Detroit, and the family farm. [1] They characterize this as the *Pandora's Box* issue for the application of CV to the measurement of nonuse values.

While accepting the breadth of possible passive use values, two measurement strategies might be forwarded: (i) restricting our focus to cases of unique goods and services where such values are likely to be relatively significant, and (ii) limiting our concern to cases of policy-specific changes. The former (i) is clearly an empirical question that can only be addressed through the accumulation of evidence. The latter (ii) raises the conceptual point that any given environmental policy may be viewed in a positive or negative manner by different segments of the population.

Consider the Hicksian equivalent (HE) welfare change measure of individual i for an exogenous environmental policy change from an initial to subsequent position (θ^0 to θ^1):

$$\mathrm{HE}_i = |m(p, \theta^1, u_i^1) - m(p, \theta^0, u_i^1)| \tag{1}$$

where m is the expenditure function, p is a vector of prices for market goods, and u_i^1 is the individual's uncompensated post-policy level of utility. Individuals are assumed to have no rights to the current status quo case (the u^0, θ^0 pair), and u^1 is the reference level of utility to be maintained. The expenditure function increases (decreases) with decreases (increases) in u^1. Thus, depending on whether θ^1 is viewed by the individual as the source of a decrease or increase in well-being, HE might represent either a willingness to pay to avoid the loss [WTPe(−)], or a willingness to accept compensation to forgo the beneficial policy change [WTAe(+)]. Depending on how the vector of policy changes (θ) impacts them, different individuals may view the proposal in different ways.

[1] Similar arguments can be found in Castle et al. (1994), and Diamond and Hausman (1994).

Table 1
Alternative welfare change measures for nonmarket impacts

	Gain (+)	Loss (−)
Hicksian compensating (HC) measure	WTPc (+)	WTAc (−)
Hicksian equivalent (HE) measure	WTAe (+)	WTPe (−)

Similar results obtain for the Hicksian compensating (HC) welfare change measure:

$$\mathrm{HC}_i = |m(p, \theta^0, u_i^0) - m(p, \theta^1, u_i^0)| \tag{2}$$

where rights are held in the status quo case, and u^0 is the reference level of utility to be maintained. For different individuals, HC might represent either the willingness to pay for the gain [WTPc(+)], or the willingness to accept compensation for the loss [WTAc(−)].

Arguing that there are separate sides to the analytical ledger for nonmarket values is not the same as the traditional WTP-WTA debate, where an individual's willingness to pay may be less than the willingness to accept compensation for the same proposed change (Hanemann, 1991). There, any ambiguity relates to the appropriate property right, whether u^0 or u^1 is the reference level of utility, and then how HC and HE measures may be expected to diverge for an individual. In contrast, the ambiguity here relates to the perceived policy impact (+ or −)—whether any given individual views a proposed exogenous change as welfare-increasing ($u^1 > u^0$) or welfare-decreasing ($u^1 < u^0$), and how this differs across the affected population.

As shown using the four welfare measures in Table 1, the WTP-WTA debate relates to moving down a particular column and comparing HC and HE. [2] We interpret Portney's concern with the 'other side of the analytical ledger' for nonmarket values as relating to whether different segments of the population belong in different columns (+ or −) for the same environmental policy change.

As an example, environmental preservation on public lands may conflict with the maintenance of traditional community values and lifestyles based on natural resource harvesting and extraction. These issues are seen repeatedly across the western US, where the concerns of growing urban populations are viewed as infringing on traditional rural lifestyles (Libby, 1994). Many traditional commercial and private uses (e.g., grazing) occur as legal privileges on the vast patchwork of public domain lands, with no correlative duty to be maintained at the status quo level. These lands are part of the public trust and are managed and regulated by a variety of federal natural resource management agencies (e.g., US Forest Service

[2] While important in some circumstances, we make no distinction here between the surplus and variation versions of HC and HE.

[USFS], Bureau of Land Management [BLM], etc.), which must also serve the demands of a broader constituency. Public preferences toward any given environmental policy on these lands are multi-dimensional, and often nonmarket in nature (Pope et al., 1984; Rostvold and Dudley, 1992). Our question is whether there are significant nonmarket values attached to the negative social impacts of an environmental policy change. [3]

Numerous discussions of the application of CV to the measurement of nonuse values generally accept that such negative values may indeed exit for any given environmental policy (Bishop and Welsh, 1992). Hanemann (1994b) and Kopp (1992) argue that to the extent such values exist, they should be measured and incorporated into benefit-cost analyses. Portney (1994) claims that, in principle, CV can be used to estimate lost existence values associated with any policy that 'destroys' jobs, and further issues the direct challenge to measure these values. [4]

Determining the size of such values is hampered by traditional CV questioning formats for environmental protection. The wording of a valuation question can induce response effects if it is inconsistent with the respondent's perception of the direction of a policy change. Identifying nonmarket values for the social impacts of an environmental policy change requires that valuation questioning formats not be biased against them. For example, using the HC measure, a willingness to pay to acquire a preservation gain [WTPc(+)] question may be source of cognitive dissonance to someone who views the proposed policy change in a negative way. Switching the property right from HC to the HE measure of willingness to accept compensation to forgo the policy change [from WTPc(+) to WTAe(+)] does not eliminate the conceptual bias. Rather, a valuation question must be framed with respect to the perceived negative impact of the policy change [WTPe(−) or WTAc(−)]. The practical design question, if a policy is viewed ambiguously across groups, is how to select the questioning format(s). The valuation of multi-dimensional policy bundles (Cummings et al., 1994; Hoehn, 1991) is likely to increase the potential for ambiguity across respondent perceptions.

In the first published study to directly address this issue, Lockwood et al. (1994) evaluate WTP for *maintaining* timber harvesting in Southeastern Australia. It is suggested that individuals may hold an *intrinsic production* value beyond any utility derived from direct harvest output. While identifying some significant positive value, it is deemed relatively inconsequential vs. the nonmarket value of reserving the same forests for national parks. However, Lockwood et al. (1994) caution against transferring their result to allocation issues that involve a 'signifi-

[3] Portney (1994) p. 13, provides prima facie evidence of a passive use value for protecting refinery jobs by asserting his own expressed preference. Likewise, Hausman (1993) p. 388, reveals his own non-environmental passive use value for protecting logging.

[4] CV estimates predicting negative values for many respondents concerning environmental protection are not altogether uncommon. However, as noted by Whitehead and Blomquist (1991), the common choice of a logarithmic functional form eliminates the prediction of negative values.

cant' traditional land use, and suggest future research into production activities that may depend on public sector subsidies.

We extend the limited empirical research exploring nonmarket values for the social impacts of environmental policy change. Our case study examines public preferences for maintaining grazing on federal public rangelands in NM.

3. The policy issue: federal public lands grazing in NM

Traditional livestock grazing in NM extends back several hundred years. Active federal management of public grazing dates to 1906 for USFS lands, and the Taylor Grazing Act of 1934 for BLM lands. The federal government owns over one-third (26.7 million acres) of all lands in NM; the USFS administers 9.3 million acres, while the BLM administers 12.9 million acres. Livestock grazing remains the predominate lands use on these federal lands in NM, and throughout the eleven western states as well. However, grazing on federal public lands accounts for only a small (1–2) percentage of total U.S. livestock production (Wilkinson, 1992). As widely recognized, public lands ranching is much more important socially, culturally, and politically than it is economically to the increasingly urban West (Pope et al., 1984; Wilkinson, 1992).

Over the last several decades, considerable controversy has emerged over public grazing policy. Whittlesey et al. (1993) identify three major issues that emerge from the recent debate: (1) rangeland quality continues to deteriorate despite federal efforts to protect and rehabilitate; (2) current stewardship is inconsistent with multiple use management and allows associated negative environmental impacts to flourish; [5] and (3) grazing fees do not reflect the full social costs of providing the forage.

Libby (1994) argues that presumptive rights granted in an earlier time are at increasing odds with emerging values. Low grazing fees originally granted to encourage western development are now viewed by some segments as subsidies, and inconsistent with environmental restoration. Any loss of presumptive rights to which people feel entitled, in the interest of protecting the rights of others, becomes a 'painful realignment' (Libby, 1994). Such social impacts are argued to be of particular concern in NM, with its long heritage of public grazing (Torell and Fowler, 1993; Wilkinson, 1992).

Responding to concerns over federal grazing policy, the Department of the Interior issued a draft environmental impact statement entitled, *Rangeland Reform*

[5] Fleischner (1994) reviews the research on ecological impacts of grazing in the west. Identified ecological concerns include: (1) loss of biodiversity, (2) disruption of ecosystem function (e.g., nutrient cycling and succession), (3) lowering of population densities for a wide variety of taxa, (4) change in community organization, and (5) change in the physical characteristics of both terrestrial and aquatic habitats.

'94 (USDI, 1993). [6] It was the outgrowth of more than two years of public discussions throughout the West. The four purposes of the proposed reform included (i) making range management more consistent with ecosystem management, (ii) accelerate the environmental restoration of rangelands, (iii) obtain a fair and reasonable payment for the grazing of livestock on public lands, and (iv) streamline administrative functions. The proposed policy change included a revision in the determination of grazing fees, which would have doubled the 1994 fee of approximately US$2 per animal unit month (AUM). [7] In NM, estimates of forage values of federal grazing permits are above the current fee per AUM, but would likely be less than the proposed doubling in the uniform rate across the 11 western states (Van Tassell et al., 1994). Rhetoric over proposed changes was heated, with western livestock interests arguing that the changes unfairly burdened ranchers, would damage rural ranch-based economies, and undermine the ranching tradition (Torell and Fowler, 1993).

Arguments concerning fairness and equity towards western ranching interests surround the grazing fee debate (Wilkinson, 1992). Permit values for public lands grazing are capitalized into ranch prices for the deeded lands in the base ranch, and thus many grazers have already paid for the full forage value of the permits (Torell and Fowler, 1993). A recent Grazing Fee Task Force concluded that the reallocation of wealth from permittees to the government is a central underlying issue (Bartlett et al., 1994).

Arguments to protect grazing interests and the status quo appear to hold considerable support within segments of the general NM population, clearly extending beyond direct ranching interests and enjoying significant political support in NM (IPP, 1994). [8] Given that any expected market impacts of range reform would be extremely small in scale relative to the NM economy, we take up Portney's (1994) challenge to investigate potential nonmarket values for the social impacts associated with a proposed environmental policy change. Further, the case study meets the Lockwood et al. (1994) suggestion for testing a traditional land use dependent upon public sector subsidies.

[6] Preferred alternatives under Rangeland Reform '94, and various revisions thereupon, did not receive legislative support in Congress. The Department of the Interior began administrative implementation of selected reform proposals in August 1995.

[7] Federal grazing fees per AUM are currently determined by an annual formula, where a US$1.23 base fee is indexed against forage values, beef prices and production prices. The base fee comes from a 1966 survey of more than 10,000 ranchers, and represents an estimated adjustment for federal and private land grazing cost differentials in 1966. Numerous grazing fee reform proposals have been suggested for changing this formula, such as increasing the base fee to the US$3–$5 range (see Bartlett et al., 1994).

[8] S. 852, 'The Livestock Grazing Act,' was proposed in mid-1995 by NM Senator Pete Domenici (R). Testimony in the Congressional Record clearly identifies the bill with protecting western livestock interests and traditional ranching communities.

4. The survey instrument

Our exploratory study is based on a telephone survey using a random sample of 684 NM residents. The survey was conducted by the Survey Research Center of the Institute for Public Policy (IPP) at the University of New Mexico. A set of questions on public lands issues was included as part of a regular quarterly profile of NM residents (IPP, 1994). Prior to the valuation question, respondents were asked a variety of attitude and awareness questions concerning public lands grazing in NM.

The policy change to be evaluated was the grazing fee increase included under the proposed Rangeland Reform '94. At the time of the survey, August 1994, the sponsoring agencies were accepting public comment on the proposed rangeland reform and grazing fee increase. The topic was widely covered by print and television media throughout NM. The specific purpose of the valuation question was to identify the presence of nonmarket values associated with avoiding the loss of the status quo policy case and the protection of traditional livestock grazing. That is, the question was framed to elicit the HE welfare measure, specifically the willingness to pay to avoid negative social impacts of range reform [WTPe(−)]. [9] This contrasts with suggestions that the nonmarket effects of environmental improvements on public rangelands should be explicitly measured using CV (Rostvold and Dudley, 1992).

The experimental design used an open-ended format for eliciting valuation responses. The payment vehicle was a voluntary contribution check-off on the state income tax form to a special fund. The trust fund using the state income check-off is a realistic payment vehicle; a proportion of federal grazing fee receipts is returned to states and counties.

A concern with valuing social impacts associated with a proposed environmental policy change is that individuals accurately understand the good being provided. To investigate this concern, the specific dimensions of the good were varied across the sample. The split sample experimental design included two separate treatments (T1, T2), a combined treatment (T3) and a control group (T4). The treatments were designed to explicitly recognize eligibility constraints for the fee-offset. Treatment one (T1) required that ranches eligible for the fee-offset must be family-owned and operated. Part of the grazing controversy has been the observation that large corporations use a significant amount of the available public lands forage. Treatment two (T2) required that ranches eligible for the fee-offset

[9] This framing is also consistent with the legal interpretation of grazing permits as privileges rather than property rights. However, it may not be consistent with the perception of some survey respondents. In particular, some western livestock supporters assert that the legal privilege is more properly construed as a right. This ambiguity is part of what must be confronted in many environmental policy cases and has implications for the detection and treatment of protest responses in CV surveys, which we explore below.

must abide by federally-mandated safe minimum range and stream protection standards. This treatment is consistent with incentive-based fee reductions, discussed in reform proposals, based on meeting minimum environmental standards. It also makes explicit the option that maintenance of traditional grazing and environmental protection not be mutually exclusive; i.e., some individuals may be willing to pay to reduce social impacts, as long as minimum environmental conditions are still met. Treatment three (T3) combines T1 and T2, while the control group (T4) receives no treatment.

The survey instrument includes some description of livestock grazing on federal public lands (USFS and BLM) in NM, and asks a number of awareness and attitudinal questions. The Rangeland Reform '94 proposal is never mentioned by name. The contingent scenario, associated split sample treatment statements, and the specific valuation question are:

> There is a government proposal to double the grazing fees paid by ranchers for the use of public lands. The fees would be used to improve sensitive areas on the public lands that may have been damaged by cattle grazing. Some people argue that the increased fee may cause some ranchers to reduce their herds and some to close down completely. Business in small towns and villages of NM that depend on ranching activity may lay off employees or go out of business entirely. Other people argue that the increased fees are needed to preserve the fragile ecology of rural NM, and that fees should be increased to match the costs of grazing on private lands.
>
> The federal government would not have to increase grazing fees if the money is made up through other revenues. One proposal is to put an optional contribution line on the NM state tax returns. A household filling in the line would agree to contribute the specified additional amount along with their taxes. A household that does not fill in the line would not pay any additional money.
>
> The revenues collected would go into a special fund. The money would offset future increases in federal grazing fees, and would be used to improve sensitive areas on public lands that may have been damaged by livestock. This would not cause a decrease in current fees, but would limit the amount they would increase. The larger the fund, the more grazing fee increases can be offset.
>
> Now, I would like to ask you a question about your willingness to contribute to such a fund. This would be a voluntary contribution over and above your state income taxes, and clearly listed on a separate line. In recent years the typical NM Household has paid between two and five hundred dollars in state income taxes per year.

Treatment 1 (T1):

> The reduction in grazing fee increases would be available only to family owned operations living on the ranch.

Treatment 2 (T2):

> The reduction in grazing fees would be available only to ranchers meeting federally-mandated safe minimum standards for range and stream protection.

Treatment 3 (T3):

> The reduction in grazing fees would be available only to ranchers meeting several conditions; they would have to be family owned operations living on the ranch; and, they would have to meet federally-mandated safe minimum standards for range and stream protection.

> Q. What is the maximum amount your household would be willing to contribute annually to the fund to preserve ranching in NM. US$_____.

A series of follow-up questions to the valuation responses was included in the survey. Specifically, individuals were asked to identify the primary motivation for providing either a positive or a zero valuation response. Detailed follow-up responses are used in the analysis of protest behavior, as suggested by Arrow et al. (1993).

5. Empirical models and analysis

After the presentation of some summary descriptive statistics from the 1994 telephone survey, we turn to the development and investigation of several alternative valuation models.

When asked what was the strongest image to come to mind when thinking of a typical ranch in NM, 51% of respondents chose a way of life as opposed to a business activity or both. When asked how important it is to help preserve the traditional way of life associated with ranching in NM, using an 11 point scale (0–10), 35.5% of respondents chose extremely important (value 10 on the scale) while only 22% chose a response in the lower half of the scale (0–6). These responses suggest an especially strong feeling for the traditional way of life represented by ranching.

Table 2 presents descriptive statistics for the entire sample, and for each treatment group. A total of 684 completed surveys were obtained, however there were 56 non-responses to the contribution (WTP) question. In addition, 16

Table 2
Selected summary statistics for willingness to pay, by treatment

Treatment	Baseline T4	Family only T1	SMS only T2	Fam. + SMS T3	Total
Sample size	154	175	179	176	684
Non-Responses	19	11	16	10	56
Outliers[a]	3	5	5	3	16
Usable Responses	132	159	158	163	612
Number WTP = 0	75	102	93	89	359
Number WTP > 0	57	57	65	74	253
Mean US$ WTP ≥ 0	31.93	18.11	20.73	17.78	21.68
	(68.11)[c]	(43.09)	(42.06)	(34.63)	(47.42)
Mean US$ WTP > 0	73.95	50.51	50.40	39.16	52.44
	(87.69)	(59.77)	(53.11)	(42.56)	(62.47)
Non-Rancher[b]	27.46	17.27	20.34	15.51	19.80
Mean US$ WTP ≥ 0	(53.28)	(42.90)	(42.39)	(30.50)	(42.59)

[a] Outliers are identified as WTP in excess of 1% of income per annum.
[b] Respondents are self-identified as participating in ranching on public lands, or not.
[c] Numbers in parentheses are standard deviations.

respondents indicated large contributions (one of US$5000 per year, another of US$3000 per year, for example) that were more than 1% of their declared annual income. Only one of these 16 respondents were involved in the ranching industry. All 16 outliers are excluded from econometric analysis. Overall, the proportion of non-zero contributions is 41%, and this proportion varies across treatments from a low of 36% for the treatment in which the fee-offset fund goes only to family-owned grazers (T1), to a high of 46% for the treatment in which the fund goes only to grazing concerns that are family owned and satisfy safe minimum standards for environmental protection (T3).

Since the sample contains a majority of zero responses, the inclusion of these zeros in both the descriptive and econometric analyses is a non-trivial concern. [10] For example, from Table 2 the mean annual household contribution is US$21.68 for the entire sample, but is US$52.44 when only the positive contributions are considered. This pattern is reflected in each of the treatment statistics, with some interesting variations. Each of the treatments, which target a particular sub-group of grazers to receive the fee-offset, has a lower mean contribution than the more

[10] Large numbers of zero responses are not uncommon in CV studies valuing environmental goods. Thus, an interesting future research issue is the examination of why people are *unwilling* to pay. In related work, Harris et al. (1992) analyze determinants of actual donation behavior to the Idaho Nongame Wildlife and Endangered Species Tax Checkoff Fund. Donors are a relatively small portion of the total population (less than 10%), whose behavior is strongly explained by both past donation behavior and situational factors such as income and sources of information.

generally targeted baseline fund (T4), even though there are no statistically significant differences between the mean contributions for each of these targeted funds.

Some respondents self-identified as being involved in ranching on public lands. These respondents may be likely to contribute more to the fund, acknowledging the public good nature of the contributions (they would benefit directly from the fund but only need contribute a fraction of the expected benefit). Indeed, ranchers do contribute more, on average than non-ranchers in the sample, but their effect is not significant, as can be seen by comparing the overall mean contribution and the non-rancher mean contribution in Table 2. The lack of impact of self-identified ranching interests is due primarily to their small numbers (4.5% of the sample).

Table 3 provides summary statistics to compare the characteristics of respondents who gave a zero contribution response with those who gave a non-zero contribution response. All values between zero and one represent sample proportions, while the importance of preserving the traditional way of life is a categorical variable and age is the only continuous variable in the table. Generally, there are few major differences between these populations in measured characteristics. As mentioned above, respondents involved in ranching are more heavily represented among those who gave a positive response. Overall there is a strong feeling that preserving the traditional way of life associated with grazing is important, and the difference in this sentiment across respondents in Table 3 is not statistically

Table 3
Summary statistics for selected characteristics, by WTP response category

Characteristic	WTP = 0	WTP > 0
Involved in ranching on public lands	0.028	0.075
Importance of preserving traditional way of life represented by ranching[a]	2.32	2.66
Age (years)	45.3	39.6
Male	0.435	0.431
Democrat	0.376	0.399
Republican	0.387	0.383
Liberal	0.164	0.194
Conservative	0.290	0.285
No more than High School education	0.348	0.237
College education or more	0.337	0.375
Income greater than US$50000	0.242	0.237
Reside in Bernalillo county[b]	0.435	0.490

Entries in the table represent the proportion of each response group that displays the characteristic except for the variables: preserving traditional way of life and age.

[a]This 11 level (0–10) response variable is rescaled to be centered on 0 with −5 very unimportant, and +5 very important.

[b]Albuquerque is in Bernalillo county, the most urban and densely populated county in New Mexico. A dummy variable on residence in Bernalillo county, as an urban/rural proxy, was insignificant in all preliminary econometric models.

significant. Respondents with a positive contribution are younger and more educated than those who would not contribute to the fee-offset fund, but otherwise there are no significant differences in Table 3.

In order to better understand the effect of covariates on the contribution of respondents, econometric models can be estimated. However, with nearly two-thirds of the sample unwilling to contribute anything, the problem of modeling a sample with a large proportion of zeros is non-trivial. There is also the problem of protest responses. While traditionally the focus in the literature has been on protest zeros, there is some evidence that 'protesters' may also give positive responses (Stevens et al., 1994).

In recognition of the lack of consensus in the literature regarding the modeling of WTP data with a large proportion of zeros, rather than choose one model a priori, we treat model specification as an empirical issue. We examine three here. The simplest model (I) is an ordinary least squares regression (OLS), which treats all zero values as valid, and fits the estimated line giving each limit observation equal weight as all non-limit values. No distinction is made for protest-type responses, and there is no allowance for the possibility of censoring. Censoring can occur when values are restricted to the non-negative domain, as is the case with prices, or contributions, since the payment vehicle in the instrument does not allow for the respondent to reveal a negative valuation of the policy change. In the presence of censoring, OLS will produce biased parameter estimates, with the degree of bias increasing with the level of censoring.

The tobit model (II) offers a method of incorporating censoring into the linear regression model and has found some use in the CV literature (Desvouges et al., 1992; Goodwin et al., 1993; Halstead et al., 1991). [11] A third modeling strategy (III) is to explicitly model valid and non-valid valuation responses using an exploratory sorting of responses to follow-up questions. A Heckman-type selectivity model can then be constructed with a probit equation modeling the valid responses and a tobit equation modeling the censored and non-censored valid responses. This system can be modeled as a two-stage process or simultaneously using full information maximum likelihood (FIML).

The structure of the three models estimated using the survey data is given below. Model I uses OLS, where WTP ≥ 0, and takes no separate account of the

[11] Goodwin et al. (1993) test a double-hurdle variant of the tobit model. The test is constructed with a probit equation for the positive (non-censored) values and a truncated regression for the positive values representing the unconstrained model, and a tobit representing the constraint that the coefficients on the covariates are identical for limit and non-limit observations. This test was attempted with our data, but the truncated model would not converge. However, neither the double hurdle model nor the truncated regression approach deal with the issue of protest responses (Goodwin et al., 1993), including potential non-zero protest responses.

large number of limit observations at zero. The willingness to pay of the i^{th} individual is represented by the linear relationship: [12]

$$\mathrm{WTP}_i = \beta X_i + d_j T_{ij} + e_i \tag{3}$$

where X is a vector of socioeconomic variables, β is a vector of coefficients to be estimated, d_j are dummy coefficients on the $j = 1,2,3$ treatments T_j, and e_i is the error term $(e_i \sim N(0, \sigma_e^2))$. Model II is the standard tobit model, and accounts for the censored observations:

$$\begin{aligned} \mathrm{WTP}_i^* &= \beta X_i + d_j T_{ij} + e_i \\ \mathrm{WTP}_i^* &= \mathrm{WTP}_i \text{ if } \mathrm{WTP}_i > 0, \\ &= 0 \text{ otherwise.} \end{aligned} \tag{4}$$

Where WTP^* is the underlying, or latent, willingness to pay, which may be negative if the maintenance of grazing thru the fee-offset is not viewed in a positive way by the respondent.

Model III retains the tobit model in the outcome equation, but additionally includes a selectivity equation on the 'validity' of the WTP response. To do this we must introduce a selection mechanism. Let Z_i be a binary variable indicating whether a valuation response is denoted as valid $(Z_i = 1)$ or not $(Z_i = 0)$; thus, WTP_i is observed only if $Z_i = 1$. It is necessary to specify the determination of Z_i, and a straight regression is ill-suited for its dichotomous nature. We use an auxiliary latent variable, Z_i^*, which is determined by:

$$Z_i^* = \gamma X_i + \lambda_j T_{ij} + u_i \tag{5}$$

where γ and λ vectors of coefficients, and u_i is an error term $(u_i \sim N(0, \sigma_u^2))$. The corresponding indicator of a valid response is:

$$\begin{aligned} Z_i &= 1, \quad \text{if } Z_i^* = \gamma X_i + \lambda_j T_{ij} + u_i > 0 \\ Z_i &= 0, \quad \text{otherwise.} \end{aligned} \tag{6}$$

The dichotomous Z_i is modeled as a probit selection equation, and jointly estimated with the tobit outcome Eq. (4), using FIML and the LIMDEP econometric package.

Estimation results of the models (I, II, III) are given in Table 4. The set of independent variables contains a number of attitudinal responses obtained before the valuation question was asked, a set of demographic questions including involvement in ranching and political ideology, and a set of dummy variables for the treatments. [13] For comparison, each model contains the same set of explanatory variables, and the treatment effects.

[12] Examination of other specifications provided qualitatively similar results. While log-normal models are common with open-ended WTP data, we want to specifically allow for negative predictions.

[13] An anonymous reviewer notes that it may be possible that individuals involved in ranching and included in the general survey sample may be expressing a combination of both willingness to pay and their own willingness to accept payment.

Table 4
Estimated parameters of empirical models

Variable	Model I: OLS $n = 612$	Model II: Tobit $n = 612$	Model III: Tobit-with-Selectivity	
			Probit $n = 612$	Tobit $n = 348$
Constant	37.9[a] (7.59)	25.6 (16.9)	0.242 (0.205)	−45.8[a] (21.9)
Economic impact of grazing important	1.62[a] (0.756)	3.70[a] (1.63)	0.004 (0.022)	5.14[a] (2.13)
Grazing as traditional way of life important	0.376 (0.852)	0.997 (1.88)	0.030 (0.025)	1.64 (2.57)
Damage caused by grazing important	−0.221 (0.765)	−1.61 (1.67)	0.062[a] (0.023)	−0.819 (2.31)
Preservation a priority in pub. land mang.	2.33 (3.99)	11.1 (8.59)	0.065 (0.115)	14.1 (11.4)
Involved in ranching on public lands	36.23[a] (8.96)	63.0[a] (17.4)	0.132 (0.269)	43.4[a] (22.0)
Age	−0.280[a] (0.092)	−0.995[a] (0.234)	−0.005[a] (0.002)	−0.970[a] (0.254)
Male	0.038 (3.90)	−0.108 (8.34)	−0.238[a] (0.112)	−8.13 (10.6)
High school education	−3.90 (4.28)	−23.6[a] (9.54)	0.268[a] (0.120)	−12.8 (12.0)
Income non-response	−17.5[a] (8.35)	−447 (2306)	−0.879[a] (0.357)	−126 (543)
Income US$20,000 to US$50,000	9.59[a] (4.64)	8.41 (9.58)	0.016 (0.132)	13.2 (12.3)
Income over US$50,000	2.23 (5.11)	−3.12 (10.7)	−0.273[b] (0.150)	0.849 (14.3)
Liberal ideology	−5.42 (5.12)	−4.38 (10.8)	−0.208 (0.146)	4.99 (15.2)
Treatment (T1): Family owned only	−11.9[a] (5.45)	−0.20[b] (11.7)	0.249 (0.152)	20.8 (13.8)
Treatment (T2): Safe Min. Standards (SMS) only	−11.7[a] (5.47)	−15.9 (11.5)	0.251[b] (0.151)	8.03 (14.2)
Treatment (T3): Family + SMS only	−13.8[a] (5.45)	−15.3 (11.4)	0.005 (0.153)	−0.013 (15.3)
Log-Likelihood	−3204.9	−1658.8	−1343.8 (FIML)	
			−1352.7 (Probit + Tobit)	
Performance statistics	Adj. $R^2 = 0.066$			
	$2(L - L_0) = 57.2$	$2(L - L_0) = 88.4$		

Numbers in parentheses are standard errors. Coefficients that are statistically different from zero at the 5% level are identified by [a], those at the 10% level by [b].

The estimated OLS model (I) explains relatively little of the variance observed in the contribution with an adjusted R^2 of only 0.07, however this is strongly influenced by the large number of zeros. The equation is significant ($\alpha < 0.01$, $df = 15$), as indicated by the χ^2 statistic of 57.2, and nine of the 16 coefficients are statistically different from zero. The stronger a respondent feels that ranching is important to the economy, the more they will contribute. Ranchers will contribute more and so will younger people. All treatments show a significantly lower level of contributions compared to the baseline treatment, rejecting the null hypothesis ($H_0: d_j = 0, \forall j$).

Turning to the tobit model (II) in Table 4. This model is more appropriate if it is believed that some of the respondents who indicated a zero contribution would have actually given a negative contribution if that was possible, or allowable. The model allows for the 'weight' of observations at zero to be accounted for in estimating the distribution of the latent variable that could take on any value, both positive and negative. The χ^2 statistic for the hypothesis that all the coefficients (β, d_j) are zero (except for the constant) is 88.4 implying the overall model is statistically significant ($\alpha < 0.01$, $df = 15$). The number of statistically significant regressors is lower than in the OLS equation, however some of the same regressors remain significant and the high school education coefficient becomes significant. Respondents with lower levels of education are more likely to indicate lower contributions. The treatments are no longer significant at the 0.05 level, but contributions to the fee-offset fund targeted at family-owned operations are significantly lower ($\alpha < 0.10$).

The last two columns of Table 4 give the estimated tobit-with-selectivity model (III). Since there are two components to this model, the selectivity equation (probit) and the valid contribution, or outcome, equation (tobit), two sets of coefficients are reported in the final two columns of Table 4. Following Stevens et al. (1994), the selection of a valid contribution is determined by examining follow-up questions. Each respondent was asked for the main factor influencing the level of contribution. The set of response choices differed for those reporting a zero contribution and for those responding with a positive contribution. Two of the four reasons for each respondent were chosen as indicating a non-valid response. Valid response choices were defined as either concerning budget constraints or the nature of the good (preserve ranching or limit environmental impacts); nonvalid responses were defined as either concerning fairness or government control issues not directly related to the nature of the good.

This criteria used is intended to be exploratory rather than definitive—to see whether information from follow-up questions can be used as a device to sort responses, which can contribute to a better performing econometric model. The response choices for those providing a positive contribution ($WTP_i > 0$) are:

1. Current household income and other financial commitments.
2. Desire to preserve traditional public lands ranching in NM.
3. Doing (your) fair share to support the program.

4. To limit additional federal government control over natural resources.

While the response choices for those reporting a zero contribution ($WTP_i = 0$) are:

1. Current household income and other financial commitments.
2. Concern for the environmental impacts of continued grazing on public lands.
3. If other people would support the program and contribute.
4. Concern with additional federal government control over natural resources.

Valid responses are defined as categories 1 and 2 in each of the above lists ($WTP_i \geq 0$). Of the 612 usable responses, 348 were identified as representing valid contributions. Of these, 56% were zeros, lending support to the contention that a focus on zeros as problematic responses ignores a potentially serious 'protest' response among positive responses (Stevens et al., 1994). The reported coefficients are the FIML estimates of the system, so independent performance statistics for the probit and tobit components are not available. As a measure of the performance of the model, the likelihood values of components estimated separately are reported in Table 4. There is some slight improvement from the simultaneous model over the separate model estimates.

Many of the coefficients are statistically significant in the probit selectivity equation, and some of the significant variables are not those that are significant in the tobit outcome equation, suggesting that the decision to report a valid contribution is dependent upon different factors than those determining the amount of the contribution. Of note, both sensitivity to environmental damage caused by grazing and the treatment (T2) requiring minimum environmental standards are positive and significant factors ($\alpha < 0.10$) in reporting a valid contribution. However, neither variable is important in determining the size of the contribution. The significant coefficients in the tobit component of the selectivity model are the same as those in the uncorrected tobit equation, except that education is no longer a significant factor.

Generally, the attempt to find statistically significant covariates for the decision to contribute, and the level of contribution, is only moderately successful, but sufficient to support the modeling strategy. Using the estimated models, and setting the independent variables to sample mean values, conditional means are presented in Table 5. The predicted mean contribution for the OLS equation is, as

Table 5
Predicted willingness to pay, E(WTP|X), in dollars ($)[a]

	OLS	Tobit[b]	Tobit-with-Selectivity[b]
Conditional Mean WTP	21.68		
Conditional Mean WTP, full underlying distribution (WTP^*)		−46.93	−71.01
Random draw from censored population		14.74	10.51
Conditional Mean WTP, non-limit observations only		51.65	49.96

[a]All independent variables are set at mean values.
[b]Greene (1993) p. 694, identifies three conditional mean functions for the tobit model, which are presented here.

expected in the linear model, the observed mean, US$21.68. Three conditional mean distributions are calculated from the tobit model, depending upon which 'component' of the underlying distribution is of interest. Since the tobit model is a censored regression approach, the model can be used to imply the entire distribution. The mean of the unobserved distribution for the tobit without selectivity is −US$46.93 per household annually. So much of the implied distribution is below zero that the mean contribution is negative, even though the observed mean contribution is positive. The mean of the censored distribution, in which a randomly drawn response could be either a limit, or a non-limit value, is US$14.74, positive, but lower than the sample mean. Finally, the estimated mean of the non-limit contributions (US$51.65) approximates the observed sample mean for positive bids (US$52.44).

The pattern of conditional means predicted using the tobit—with–selectivity model (III) is similar to the uncorrected tobit model (II), but the distributions appear to have lower means than the OLS model, especially the distribution without censoring, which has a predicted mean of −US$71.01. These models together imply that while some 40% of the sample would be willing to contribute a positive amount of money to a fund intended to offset any grazing fee increases, the average amount is not large, but not trivial either. Alternatively, 60% of the sample does not place a positive value on the program. If the censoring model is an appropriate interpretation of the data, then the value to the population as a whole of offsetting fees is not positive, despite the overwhelming sentiment that the traditional way of life that grazing on public lands represents is worthy of preservation. This would appear to be an indirect indicator of preferences for the environmental gains of proposed range reform. However, interpretation of the determinants of negative predictions for the underlying latent value is difficult, given that in the tobit it must be mirrored from the preferences for avoiding social impacts of range reform.

6. Discussion and conclusions

The basic research question can be restated as: In the case of a proposed policy change aimed at environmental restoration, but also involving social impacts, are there nonmarket values associated with maintaining the status quo? Our results indicate the presence of such a nonmarket value for maintaining federal lands grazing in NM. Approximately 40% of the sample population provided a positive contribution value. Over the entire sample, the mean value was approximately US$21 per household annually, with a corresponding mean value of US$52 for the portion of the sample willing to contribute a positive amount.

While identifying the presence of such nonmarket values for a considerable slice of the general NM population, there is clear room for improved understanding of the determinants of these expressed preferences. An explanatory variable on

the perceived importance of grazing as a *traditional way of life* was never a significant determinant. The family-owned ranch constraint on fee offset eligibility was weakly significant ($\alpha < 0.10$) but negative in the tobit model, and insignificant in the tobit-with-selectivity model. Thus, there is little evidence that the expressed positive contributions are strongly motivated by any sense of cultural heritage for traditional grazing and the family-owned ranch. One alternative hypothesis for future investigation is that these preferences may instead be related to avoiding negative social impacts more generally; i.e., both sides of the nonmarket ledger may be susceptible to 'good cause' effects.

Using tobit and tobit-with-selectivity models, the overall predicted sample mean of the implied full distribution for the underlying willingness to pay (WTP^*) is actually negative ($-$US$47 and $-$US$71, respectively). This overall negative public valuation holds across eligibility requirements imposed on ranches. Thus, the overall results may indicate that respondents generally would not subsidize activities they perceive as environmentally destructive, even if it adds to or is part of a western culture. However, inferences concerning negative valuations must be made from non-negative valuation responses. The preferred approach would be to investigate this negative portion more directly, with valuation questions that are not biased against it. We argue that the same logic holds for the numerous CV studies for environmental policy changes that ignore the reverse case.

The methodological implication is that the full investigation of the nonmarket effects of controversial environmental policy changes must accommodate multiple perspectives. Future CV studies of controversial environmental issues should be geared towards asking separate valuation questions of both proponents and opponents of a posited policy change. This has further implications for both experimental survey design, and the empirical analysis of results. From an ex ante survey design perspective, one practical approach is the use of screening questions to create a *sieve* to determine whether a particular respondent views the posited change in a positive or negative manner. The survey designer could first ask a sorting question, and then depending on the response, separate valuation questions may be asked of different groups. Such an approach is used by Buhr et al. (1993) in a food safety laboratory valuation experiment. From an ex poste data analysis perspective, the presence of distinct population sub-samples may point toward more complex modeling approaches (e.g., the use of mixed distributions).

In summary, in an exploratory CV study specifically designed to investigate the 'other side of the analytical ledger' (Portney, 1994), we find evidence of nonmarket values associated with avoiding social impacts for a proposed environmental policy change. By switching the traditional perspective in a nonmarket investigation we demonstrate another dimension of nonmarket values, and the need to accommodate multiple perspectives. However, consistent with the limited empirical research in this area (e.g., Lockwood et al., 1994), the evidence also suggests the potential for *larger* environmental nonmarket effects. Future nonmarket

research should be aimed at simultaneously investigating both sides of controversial environmental policy changes. Our hope is that this exploratory study spurs further research in this area.

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